A Superconducting Cryostat for Research and Student Training in Magnetoelectronic Materials

Anne Reilly and Gunter Luepke, College of William and Mary, DMR-0114124

Magnetoelectronic thin films and their unique properties such as giant and colossal magnetoresistance (GMR and CMR) are revolutionizing electronics. Many questions remain on the dynamics of electron spins in these materials.

The use of ultrafast nonlinear optical techniques for measuring spin and magnetization lifetimes are being applied with much success to answer some of these questions.

A recently acquired magnetooptical cryostat allows a wide range of material systems to be studied from temperatures of 1.5 – 300 K and fields up to 9 Tesla. The material systems studied include ferromagnetic/semiconducting multilayer systems such as ZnMnSe/AlGaAs, magnetite materials displaying CMR and half-metallic materials such as CrO_2.

Figure 1. The 9 Tesla superconducting magnetooptical cryostat (blue) recently installed at the College of William and Mary.

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Educational:
4 graduate students
1 undergraduate student

Students are being trained in the areas of magnetooptical measurements and electronic and magnetic behavior of ferromagnetic thin film systems.

Two courses have been developed in this pursuit: a seminar course on ferromagnetism and a full lecture course on magnetism in highly correlated electron systems.

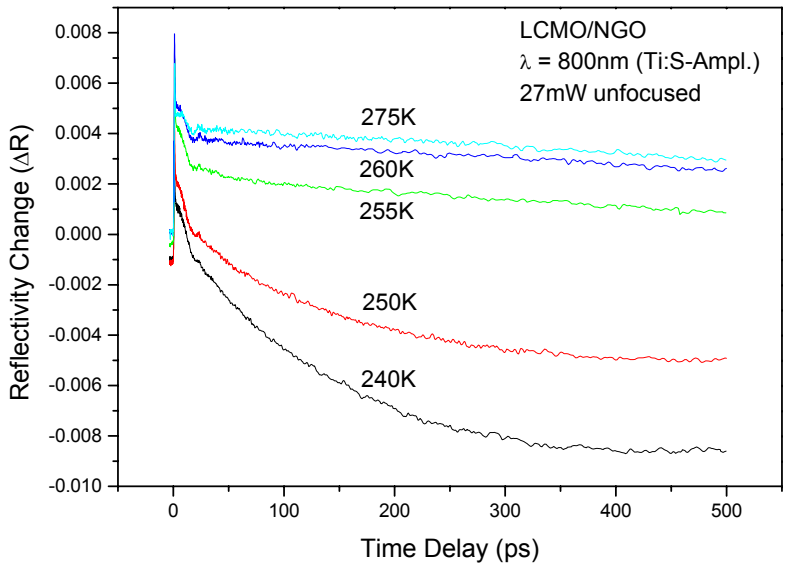

Figure 2: Decay of the reflectivity change in a pump-probe laser experiment for a LCMO thin film, which displays colossal magnetoresistance.